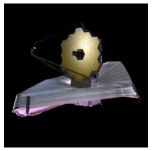

6866 - Sakurai's Object - mineralogy and morphology

Cycle: 4, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NIRSpec-Mosaic2x2-v4334Sgr				
	1	V4334 Sgr NIRSpec IFU mosaic	NIRSpec IFU Spectroscopy	(3) V4334SGR_IFU
MRS-V4334Sgr				
	2	BKGR-MRS-CH123-V4334Sgr	MIRI Medium Resolution Spectroscopy	(2) BKGR-V4334SGR
	3	MRS-CH123-V4334Sgr	MIRI Medium Resolution Spectroscopy	(1) V4334SGR

ABSTRACT

Intermediate mass (0.8-8 Msun) stars, after evolving away from the Asymptotic Giant Branch, become planetary nebulae and eventually hot young white dwarfs. During this evolution, they undergo a series of Helium shell flashes (thermal pulses). In some cases, a very late Helium shell flash (a very late thermal pulse - VLTP) may occur that raises the star from the embers of a cooling white dwarf back to the original luminous giant stage. The evolution is reversed, and the star - Phoenix-like - rises from the ashes and is born-again. The known cases of this dramatic regeneration are extremely few , Sakurai's object (SO) being the prime example. Further, how a star evolves after being born-again is completely uncharted territory. There is therefore a compelling need to document it. SO's present evolution is dominated by its dust shell, and so its study is centered around the mid-IR. JWST observations are critical to address our goals, which are to (i) determine the early morphology of the material ejected following the VLTP, (ii) determine the mineralogy of the ejecta, and (iii) test and constrain models of VLTP evolution using JWST 3d spectral-spatial cubes.

OBSERVING DESCRIPTION

SO is at ecliptic latitude +5.7degrees; its coordinates are accurately known. The MAZ safe zone gives observing windows 8 Aug - 24 Sept 2025, 14 Mar - 1 May and 8 Aug - 24 Sept 2026. We have no reason to deviate from these dates.

For NIRSpec IFU, a 4pt on-source dither is invoked to provide robustness against dead pixels, and cosmic ray hits for the pipeline reduction. Based on implementation recommendations from the assigned NIRSpec support instrument scientist, T. Boeker, we have adjusted small parts of the APT strategy by adjusting the NIRSpec IFU to give a 2*2 mosaic. A 2x2 tile is executed to trace potential extended features. We require G140H/F100LP, G235H/F100W, and G395H/F290LP to obtain the spectrum in the range 1-5microns, with s/n increasing from 30 (short wavelengths) to 900 (long wavelengths). This is required to capture absorption features (solid, molecular) and emission features.

MRS observations use channels 1,2,3 A,B,C to attain s/n >~ 200 in the continuum. The MRS The background position is executed first followed by the on-source position following recommendations from the program assigned instruments scientist (IS). Background 4-pt dither pattern optimized for BACKGROUND. On-source 4-pt dither pattern optimized for EXTENDED source. Simulatenous imaging is purposely not performed.

Revisions still permits the entirety of the program to fit into the TAC awarded hours, and does not impact achieving the science goals outlined in the proposal.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V4334SGR	RA: 17 52 32.6935 (268.1362229d) Dec: -17 41 8.02 (-17.68556d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: Source in crowded field, background postion selected using WISE W2 images. Reuiqres a background image to be obtained see observational link requirement. Category=Star Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta] Extended=NO				
(2)	BKGR-V4334SGR	RA: 17 52 32.4700 (268.1352917d) Dec: -17 43 3.80 (-17.71772d) Equinox: J2000	Epoch of Position: 2000	
Comments: Source in crowded field, background postion selected using NeoWISE W2 images. Category=Star Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta] Extended=NO				
(3)	V4334SGR_IFU	RA: 17 52 32.6935 (268.1362229d) Dec: -17 41 8.02 (-17.68556d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	
Comments: Source in crowded field, background postion selected using WISE W2 images. Category=Star Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta] Extended=NO				

Observation

Proposal 6866, Observation 1: V4334 Sgr NIRSpec IFU mosaic

Tue Jun 24 21:00:12 GMT 2025

Diagnostic Status: Warning

Observing Template: NIRSpec IFU Spectroscopy

Comments: A 4pt dither is invoked to provide robustness against dead pixels, and cosmic ray hits for the pipeline reductions. A 2x2 tile is executed to trace potential extended features.

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	V4334SGR_IFU	RA: 17 52 32.6935 (268.1362229d) Dec: -17 41 8.02 (-17.68556d) Equinox: J2000	Proper Motion RA: 0 Proper Motion Dec: 0 Epoch of Position: 2000	

Comments: Source in crowded field, background postion selected using WISE W2 images.
Category=Star
Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta]
Extended=NO

Template

TA Method	HFF Readout Mode
NONE	false

Mosaic

Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order
2	2	15.0	10.0	0.0	0.0	DEFAULT

Dithers

#	Dither Type	Size	Starting Point	Number of Points	Points
1	4-POINT-DITHER				

Spectral Elements

#	Grating/Filter	Readout Pattern	Groups/Int	Integrations/Exp	Leakcal	Dither	Autocal	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	G140H/F100LP	NRSIRS2RAPID	26	1	false	true	NONE	4	4	1575.6	248015
2	G235H/F170LP	NRSIRS2RAPID	12	1	false	true	NONE	4	4	758.622	248015
3	G395H/F290LP	NRSIRS2RAPID	5	1	false	true	NONE	4	4	350.133	248015

Observation

Proposal 6866, Observation 2: BKGR-MRS-CH123-V4334Sgr Tue Jun 24 21:00:12 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observation For: [MRS-CH123-V4334Sgr (Obs 3)]

Comments: The background position is executed first followed by the on-source position following recommendations from the program assigned instruments scientist (IS). Background 4-pt dither pattern optimized for BACKGROUND. Simulatenous imaging is purposely not performed.

Diagnostics

(BKGR-MRS-CH123-V4334Sgr (Obs 2)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(BKGR-MRS-CH123-V4334Sgr (Obs 2)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	BKGR-V4334SGR	RA: 17 52 32.4700 (268.1352917d) Dec: -17 43 3.80 (-17.71772d) Equinox: J2000	Epoch of Position: 2000	

Comments: Source in crowded field, background postion selected using NeoWISE W2 images.
Category=Star
Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
	All MRS	NO	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	BACKGROUND	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SHORT(A)	MRSLONG		FASTR1	5	1	1	Dither 1	4	4	55.501	
1	SHORT(A)	MRSSHORT		FASTR1	5	1	1	Dither 1	4	4	55.501	
2	MEDIUM(B)	MRSLONG		FASTR1	5	1	1	Dither 1	4	4	55.501	
2	MEDIUM(B)	MRSSHORT		FASTR1	5	1	1	Dither 1	4	4	55.501	
3	LONG(C)	MRSLONG		FASTR1	4	1	1	Dither 1	4	4	44.401	248015
3	LONG(C)	MRSSHORT		FASTR1	4	1	1	Dither 1	4	4	44.401	248015

Special Requirements	
	Sequence Observations 2, 3, Non-interruptible

Observation

Proposal 6866, Observation 3: MRS-CH123-V4334Sgr Tue Jun 24 21:00:12 GMT 2025

Diagnostic Status: Warning

Observing Template: MIRI Medium Resolution Spectroscopy

Background Observations:[BKGR-MRS-CH123-V4334Sgr (Obs 2)]

Comments: The background position is executed first followed by the on-source position following recommendations from the program assigned instruments scientist (IS). On-source 4-pt dither pattern optimized for EXTENDED source. Simulatenous imaging is purposely not performed.

Diagnostics

(MRS-CH123-V4334Sgr (Obs 3)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(MRS-CH123-V4334Sgr (Obs 3)) Warning (Form): Groups/Int cannot be 1, Groups/Int = 2 requires permission and Groups/Int of 3-4 is allowed but not recommended.

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	V4334SGR	RA: 17 52 32.6935 (268.1362229d)	Proper Motion RA: 0	
		Dec: -17 41 8.02 (-17.68556d)	Proper Motion Dec: 0	
		Equinox: J2000	Epoch of Position: 2000	

Comments: Source in crowded field, background postion selected using WISE W2 images. Reuiqres a background image to be obtained see observational link requirement.
Category=Star
Description=[Asymptotic giant branch, Cataclysmic variable stars, Dust shell, Ejecta]
Extended=NO

Acquisition

#	Target
1	NONE

Template

AcqFilter	Primary Channel	Simultaneous Imaging	Imager Subarray	Grating Wheel Direction
FND	All MRS	NO	FULL	Allow Auto Reorder

Dithers

#	Dither Type	Optimized For	Direction
1	4-Point	EXTENDED SOURCE	NEGATIVE

Spectral Elements

#	Wavelength Range	Detector	Filter	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Dither	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	SHORT(A)	MRSLONG		FASTR1	5	1	1	Dither 1	4	4	55.501	248015
1	SHORT(A)	MRSSHORT		FASTR1	5	1	1	Dither 1	4	4	55.501	248015
2	MEDIUM(B)	MRSLONG		FASTR1	5	1	1	Dither 1	4	4	55.501	248015
2	MEDIUM(B)	MRSSHORT		FASTR1	5	1	1	Dither 1	4	4	55.501	248015
3	LONG(C)	MRSLONG		FASTR1	4	1	1	Dither 1	4	4	44.401	248015
3	LONG(C)	MRSSHORT		FASTR1	4	1	1	Dither 1	4	4	44.401	248015

Special Requirements	Sequence Observations 2, 3, Non-interruptible